

Technical  
Program

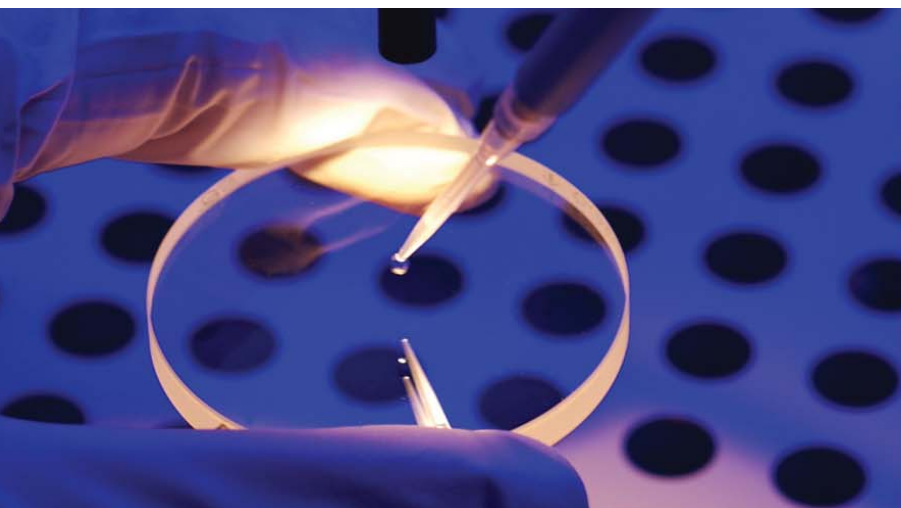
# SPIE Optifab

**Conference Dates: 11-14 May 2009**

**Exhibition Dates: 12-14 May 2009**

Rochester Riverside Convention Center

Rochester, New York, USA



*Co-sponsored by*



**The American Precision  
Optics Manufacturers  
Association**

*Sponsored by*



**SPIE**

Connecting minds. Advancing light.



# SPIE

## Optifab

**Conference Dates: 11-14 May 2009**

**Exhibition Dates: 12-14 May 2009**

Rochester Riverside Convention Center  
Rochester, New York, USA

## SPIE Onsite Services

### Rochester Riverside Convention Center

123 East Main St.  
Rochester, NY 14604-1619  
Tel: (585) 232-7200, Fax: (585) 232-1510,  
www.rrcc.com

### Registration Hours

*Rochester Riverside Convention Center  
Registration*

*Convention Center Galleria*

Monday–Tuesday . . . . . 7:30 am to 5:00 pm  
Wednesday . . . . . 7:30 am to 5:30 pm  
Thursday . . . . . 7:30 am to 3:00 pm

### Exhibition Hours

*Rochester Riverside Convention Center  
Empire Hall*

Tuesday . . . . . 10:00 am to 5:00 pm  
Wednesday . . . . . 10:00 am to 5:30 pm  
Networking Reception and  
Poster Viewing . . . . . 4:30 to 5:30 pm  
Thursday . . . . . 10:00 am to 3:00 pm

### Networking Reception and Poster Viewing

*Empire Hall*

Wednesday . . . . . 4:30 to 5:30 pm

All attendees are invited to relax, socialize, and enjoy refreshments.

Conference posters will be on display. Poster authors will be present for discussion from 4:30 to 5:30 pm.

### Message Center

*Rochester Riverside Convention Center,  
Near Registration*

Messages will be taken during registration hours Monday through Thursday by calling +1 585 770-2360.

### WiFi

### Complimentary Internet Wireless Access

Sponsored by:



Complimentary wireless access to the Internet for all attendees is available in the Empire Lounge.

### Coffee Breaks at the Convention Center

Complimentary coffee will be served in the Exhibition Hall, Tuesday through Thursday each day at approximately 10:00 am and 3:00 pm.

*Tuesday Sponsored by:*



*Wednesday Sponsored by:*



### About SPIE

SPIE is a not-for-profit international society dedicated to furthering technological innovations. Established in 1955, SPIE has a long history of producing international meetings that push the forefront of photonics technologies and their applications.

### About APOMA

The American Precision Optics Manufacturers Association represents a broad base of precision optics manufacturers and supporting industries whose mutual interest is to expand and advance optics manufacturing technology. The 150-member organization promotes regional educational centers for the optics industry, provides student grant funding, participates in the formation of optical standards for the industry, and actively sponsors technical workshops aimed at improving technical dialogue and exchange within the membership.



## Policies

### Audio, Video, Digital Recording Policy

**In the Meeting Rooms and Poster Sessions:** For copyright reasons, recordings of any kind are strictly prohibited without prior written consent of the presenter in any conference session, course or of posters presented. Each presenter being taped must file a signed written consent form. Individuals not complying with this policy will be asked to leave a given session and asked to surrender their film or recording media. Consent forms are available at the SPIE Audiovisual Desk.

**In the Exhibition Hall:** For security and courtesy reasons, photographing or videotaping individual booths and displays in the exhibition hall is allowed ONLY with explicit permission from onsite company representatives. Individuals not complying with this policy will be asked to surrender their film and to leave the exhibition hall.

### Underage Persons on Exhibition Floor

For safety and insurance reasons, no persons under the age of 16 will be allowed in the exhibition area during move-in and move-out. During open exhibition hours, only children over the age of 12 accompanied by an adult will be allowed in the exhibition area.

### Unauthorized Solicitation

Unauthorized solicitation in the Exhibition Hall is prohibited. Any nonexhibiting manufacturer or supplier observed to be soliciting business in the aisles, or in another company's booth, will be asked to leave immediately.

### Unsecured Items

Personal belongings such as briefcases, backpacks, coats, book bags, etc. should not be left unattended in meeting rooms or public areas. These items will be subject to removal by security upon discovery.

## Authors & Presenters

### Speaker Audiovisual Equipment

All conference rooms will have a projector, screen, lapel microphone, and laser pointer.

### Poster Set up and Viewing

Set up: Wednesday . . . . . 10:00 am to 4:30 pm  
Discussion: Wednesday . . . . . 4:30 to 5:30 pm

Authors are encouraged to set up posters during morning coffee break on Wednesday. Posters will be available for viewing throughout the day on Wednesday.

Poster paper numbers will be pre-posted on the poster boards and push pins will be provided. Presenters who have not placed their poster presentations on their assigned board by 4:30 pm on Wednesday will be considered a "no show."

Authors should be present for discussion during the Networking Reception from 4:30 to 5:30 pm.

Presenters should remove their posters at the end of the interactive poster session. Posters not removed will be considered unwanted and will be discarded.

### Laser Pointer Safety Information

SPIE supplies tested and safety approved laser pointers for all conference meeting rooms, and for short course rooms if instructors request one. For safety reasons, SPIE requests that presenters use our provided laser pointers available in each meeting room.

If using your own laser pointer, have it tested at your facility to make sure it has <5 mW power output. Laser pointers in Class II and IIIa (<5 mW) are eye safe if power output is correct - but don't automatically trust the labeling. Commercially available laser pointers, red or green (or any color), could be incorrectly labeled as to their wavelength and power output.

Presenters intending to use their own laser pointer for presentations are required to come to the Speaker Check In Desk onsite and test their pointer on our power meter. If the pointer fails the safe power level you may not use the pointer at the conference. You will be required to sign a waiver releasing SPIE of any liability for use of potentially non-safe laser pointers.

Use of a personal laser pointer at an SPIE event represents user's acceptance of liability for use of a non-SPIE supplied laser pointer device. Misuse of any laser pointer could lead to eye damage.

## Conference Chairs



**James J. Kumler,**  
Coastal Optical Systems  
Inc. (USA)



**Matthias Pfaff,**  
OptoTech  
Optikmaschinen  
GmbH (Germany)

## Steering Committee

**Michael J. Bechtold,** OptiPro Systems (USA)

**Christopher T. Cotton,** ASE Optics, Inc. (USA)

**Walter C. Czajkowski,** Edmund Optics Inc.  
(USA)

**Thomas Danger,** Schneider GmbH & Co. KG  
(Germany)

**Toshihide Dohi,** Optiworks, Inc. (Japan)

**Edward M. Fess,** Univ. of Rochester (USA)

**Thomas Godin,** Satisloh North America Inc.  
(USA)

**Donald Golini,** QED Technologies Inc. (USA)

**Justin Mahanna,** Universal Photonics Inc.  
(USA)

**Michael P. Mandina,** Optimax Systems, Inc.  
(USA)

**Ted Mooney,** ITT Corp. (USA)

**Daniel Musinski,** Zygo Corp. (USA)

**Richard A. Nasca,** Corning Tropol Corp. (USA)

**John J. Nemechek,** Metrology Concepts LLC  
(USA)

**Basilio Nesti,** Naked Optics Corp. (USA)

**Robert F. Novak,** APOMA (USA)

**Yazid Tohme,** Moore NanoTechnology  
Systems, LLC (USA)

**James M. Sydor,** Sydor Optics, Inc. (USA)

**Paul R. Tolley,** Syntec Optics, Inc. (USA)

**Martin J. Valente,** College of Optical Sciences/  
The Univ. of Arizona (USA)

**Paul Meier-Wang,** AccuCoat Inc. (USA)

**Kirk Warden,** LaCroix Optical Co. (USA)

## Promotional Partners

**Laser Focus World**  
**Optics and Laser Europe**  
**Optics.org**  
**The Optronics Co. Ltd.**  
**Photonics Media**



# Daily Event Schedule

Monday	Tuesday	Wednesday	Thursday
<b>Technical Conference</b> (Kumler, Pfaff, Sydor, Nasca)			
SC350 <b>Optical Manufacturing Overview</b> (Novak) 8:30 am to 5:30 pm, \$500 / \$595	SC015 <b>Structural Adhesives for Optical Bonding</b> (Daly) 8:30 am to 12:30 pm, \$305 / \$355	SC720 <b>Cost-Conscious Tolerancing of Optical Systems</b> (Youngworth) 8:30 am to 12:30 pm, \$305 / \$355	See SPIE Cashier to register for the Technical Conference or a course.
SC013 <b>Precision Mounting of Optical Components</b> (Yoder, Jr.) 8:30 am to 5:30 pm, \$585 / \$680	SC700 <b>Understanding Scratch and Dig Specifications</b> (Aikens) 8:30 am to 12:30 pm, \$355 / \$405	SC863 <b>Understanding ISO-10110: The Optics Drawing Standard</b> (Aikens) 8:30 am to 5:30 pm, \$675 / \$770	
SC212 <b>Modern Optical Testing</b> (Wyant) 1:30 to 5:30 pm, \$315 / \$385	SC848 <b>Fundamentals of Single Point Diamond Turning</b> (Schaefer) 1:30 to 5:30 pm, \$305 / \$355	SC552 <b>Aspheric Optics: Design, Fabrication, and Test</b> (Fischer) 1:30 to 5:30 pm, \$390 / \$440	
	SC220 <b>Optical Alignment Mechanisms</b> (Guyer) 1:30 to 5:30 pm, \$305 / \$355		
<b>Exhibition</b>			
10:00 am to 5:00 pm		10:00 am to 5:30 pm	10:00 am to 3:00 pm
		<b>Commercial Presentations—</b> Exhibition Hall, 1:00 to 5:30 pm	
<b>Exhibitor Product Demonstrations, 10:30 to 5:00 pm</b>			
		<b>Networking Reception and Poster Viewing,</b> Empire Hall, 4:30 to 5:30 pm	



## Don't miss the cutting-edge exhibition

Optifab Exhibition is an international event showcasing optical manufacturing technology, including operations, machines, tools, materials, instrumentation, metrology, and processes. Don't miss the chance to do months of product research and take advantage of teaming opportunities at *the* premier optical fabrication exhibition.

### See the latest in

- ▶ Optical fabrication equipment
- ▶ Optical components, materials, and systems
- ▶ Optomechanical components/devices
- ▶ Laser system components
- ▶ Optical thin film coatings
- ▶ Optical metrology and testing equipment
- ▶ Clean room equipment
- ▶ With product demonstrations

### Exhibition Hours

Rochester Riverside Convention Center  
Empire Hall

Tuesday . . . . . 10:00 am to 5:00 pm  
 Wednesday . . . . . 10:00 am to 5:30 pm  
 Networking Reception and  
 Poster Viewing . . . . . 4:30 to 5:30 pm  
 Thursday . . . . . 10:00 am to 3:00 pm

*“Our time spent at SPIE Optifab is invaluable because we learn about the latest advances in materials and fabrication technology, and at the same time work on securing new business opportunities.”*

**Kirk Warden,**  
LaCroix Optical

# Technical Program

Monday-Thursday 11-14 May 2009



**Conference Chairs:** James J. Kumler, Coastal Optical Systems, Inc.; Matthias Pfaff, OptoTech Optikmaschinen GmbH (Germany); James M. Sydor, Sydor Optics, Inc.; Richard A. Nasca, Corning Inc.

**Program Committee:** Michael J. Bechtold, OptiPro Systems; Christopher T. Cotton, ASE Optics, Inc.; Walter C. Czajkowski, Edmund Optics Inc.; Thomas Danger, Schneider GmbH & Co. KG (Germany); Toshihide Dohi, OptiWorks, Inc. (Japan); Edward M. Fess, Univ. of Rochester; Thomas Godin, Satisloh North America Inc.; Donald Golini, QED Technologies, Inc.; Justin Mahanna, Universal Photonics Inc.; Michael Mandina, Optimax Systems, Inc.; Ted Mooney, ITT Corp.; Daniel J. Musinski, Zygo Corp.; John J. Nemecek, Metrology Concepts LLC; Buzz Nesti, Naked Optics Corp.; Robert F. Novak, APOMA; Yazid E. Tohme, Moore Nanotechnology Systems, LLC; Paul R. Tolley, Infotonics Technology Ctr.; Martin J. Valente, College of Optical Sciences/The Univ. of Arizona; Paul Meier-Wang, AccuCoat Inc.; Kirk Warden, LaCroix Optical Co.

## Monday 11 May

### SESSION 1

Room: Highland A. . . . . Mon. 8:00 to 10:00 am

#### Optical Materials

*Session Chair:* James M. Sydor, Sydor Optics, Inc.

8:00 am: **Optical glass: status and perspective**, Peter Hartmann, SCHOTT AG (Germany); Herbert Gross, Uwe Hamm, Carl Zeiss AG (Germany); Joachim Giesekeus, Spectaris e.V. (Germany) . . . . . [TD06-01]

8:20 am: **Say cheese: food for thought about materials properties and processing**, Ray Williamson, Ray Williamson Consulting (United States) . [TD06-02]

8:40 am: **Optimisation strategy for aluminum optics using the melt spinning technology**, Albert J. Bosch, Roger Senden, RSP Technology B.V. (Netherlands); Guido P. H. Gubbels, Bart van Venrooy, TNO Science and Industry (Netherlands) . . . . . [TD06-03]

9:00 am: **Frequency response of polishing pitch samples**, Brigid A. Mullany, Elizabeth Corcoran, The Univ. of North Carolina at Charlotte (United States) . . . . . [TD06-04]

9:20 am: **Fabrication and bonding of single crystal silicon**, Roger A. Paquin, Douglas R. McCarter, Eloise T. McCarter, McCarter Machine, Inc. (United States) . . . . . [TD06-05]

9:40 am: **Impact of outgassing organic contamination on laser induced damage of optics**, Karell Bien-Aïme, Commissariat à l'Energie Atomique (France) and Univ. Bordeaux I (France); Jérôme Néauport, Isabelle Tovina-Pecault, Commissariat à l'Energie Atomique (France); Evelyne Fargin, Univ. Bordeaux I (France) . . . . . [TD06-06]

Coffee Break . . . . . 10:00 to 10:30 am

### SESSION 2

Room: Highland A. . . . . Mon. 10:30 am to 12:10 pm

#### Optical Manufacturing

*Session Chair:* Peter Hartmann, SCHOTT AG (Germany)

10:30 am: **High stock removal: low sub-surface damage grinding with 3M™ Trizact™ diamond tile abrasive pads**, Tim D. Fletcher, Vince Romero, Bruce A. Svntek, Frank Frucci, John Gagliardi, 3M Co. (United States) . . . . . [TD06-65]

10:50 am: **Increased UV transmission by improving the polishing processes for fused silica**, Jessica E. DeGroot, Tobias Nitzsche, Jonathan T. Watson, Donald K. Henry, Andrew A. Haefner, Robert A. Wiederhold, Optimax Systems, Inc. (United States) . . . . . [TD06-08]

11:10 am: **Design and development of a new mechanical actions measurement device for a glass grinding machine: impact on SSD**, Jean-Philippe Champreux, Olivier Cahuc, Philippe Darnis, Jean-Yves K'nevez, Raynald Laheurte, Univ. Bordeaux I (France); Jérôme Néauport, Nathalie Darbois, Commissariat à l'Energie Atomique (France); Gaetan Albert, Univ. Bordeaux I (France) . . . . . [TD06-09]

11:30 am: **New developments in edging technology**, Steffan Moos, Volker Bickel, OptoTech Optikmaschinen GmbH (Germany) . . . . . [TD06-10]

11:50 am: **Recent advances in hydrodynamic polishing using HyDRa**, Erika Sohn, Elfego Ruiz, Esteban A. Luna, Luis Salas, Jorge Valdéz, Manuel Núñez, Univ. Nacional Autónoma de México (Mexico) . . . . . [TD06-11]

Lunch Break . . . . . 12:10 to 1:40 pm

### SESSION 3

Room: Highland A. . . . . Mon. 1:40 to 3:20 pm

#### Aspheric Manufacturing I

*Session Chair:* Richard A. Nasca, Corning Inc.

1:40 pm: **Improved asphere production using MRF® and SSI®**, Alex Pisarski, Christopher A. Hall, Christopher M. Supranowitz, Robert W. Hallock, QED Technologies, Inc. (United States) . . . . . [TD06-12]

2:00 pm: **Rapid fabrication of aspheres: a new paradigm**, Pradeep K. Subrahmanyam, George Gardopee, David Proscia, Thomas E. Metz, Steve Shifman, RAPT Industries, Inc. (United States) . . . . . [TD06-13]

2:20 pm: **Recent developments in finishing of deep concave, aspheric, and plano surfaces utilizing the UltraForm 5-axes computer controlled system**, Scott Bambrick, Michael J. Bechtold, David E. Mohring, Joseph P. Meisenzahl, OptiPro Systems (United States) . . . . . [TD06-67]

2:40 pm: **3D processing of optical surfaces: grinding, polishing, measuring**, Roland Mandler, OptoTech Optikmaschinen GmbH (Germany) . . . . . [TD06-15]

3:00 pm: **Strategies for grinding optical free forms using ball shaped grinding wheels**, Christian Vogt, Rolf Rascher, Fachhochschule Deggendorf (Germany) . . . . . [TD06-16]

Coffee Break . . . . . 3:20 to 3:50 pm

### SESSION 4

Room: Highland A. . . . . Mon. 3:50 to 5:30 pm

#### Aspheric Manufacturing II

*Session Chair:* Kevin P. Thompson, Optical Research Associates

3:50 pm: **Corrective polishing of strongly curved aspheric silicon carbide mirrors**, Guido P.H. Gubbels, Fred Kamphues, Bob den Dulk, Casper van Drunen, Wim Gielesen, Paula Bejarano, TNO Science and Industry (Netherlands) . [TD06-17]

4:10 pm: **Finishing complex mold inserts by abrasive vibration polishing**, Heiko Schulte, Oltmann Riemer, Ekkard Brinksmeier, Univ. Bremen (Germany) . [TD06-18]

4:30 pm: **Single point diamond turning of aspheric surfaces: processing parametric interplay effects on profile accuracies**, RamaGopal V. Sarepaka, Vinod K. Mishra, Dole Ram, Amandeep Singh, Arvinder Singh, Amrinder Kumar, Ganga Sharan Singh, Central Scientific Instruments Organisation (India) . [TD06-20]

4:50 pm: **Active optics and stress polishing for VLT AO instrumentation**, Emmanuel Hugot, Marc Ferrari, Gérard R. Lemaitre, Kacem ElHadi, Pascal Vola, Observatoire Astronomique de Marseille-Provence (France); Jean-Francois Carré, Denis Fappani, Société Européenne de Systèmes Optiques (France); Kjetil Dohlen, Observatoire Astronomique de Marseille-Provence (France); Pascal Puget, Jean-Luc Beuzit, Observatoire de Grenoble (France); Robin Arsenault, Norbert Hubin, European Southern Observatory (Germany) . . . . . [TD06-21]

5:10 pm: **Fabrication of optics with V grooves on freeform surface**, Wenda Jiang, LPI Precision Optics Ltd. (Hong Kong, China) . . . . . [TD06-07]

# Technical Program

## Tuesday 12 May

### SESSION 5

Room: Highland A. . . . . Tues. 8:00 to 11:50 am

#### Optical Engineering

*Session Chair: James J. Kumler, Coastal Optical Systems, Inc.*

- 8:00 am: **Design, fabrication and testing of wafer chucks**, Marcel Achtsnick, Oliver Baldus, Volker Schmidt, Berliner Glas KGaA Herbert Kubatz GmbH & Co. (Germany) . . . . . [TD06-22]
- 8:20 am: **Opto-mechanical design and fabrication of a highly reliable and light weight stray light baffle**, Thomas Zeh, Kayser-Threde GmbH (Germany); Joe Jachlewski, Berl Stein, NiCoForm, Inc. (United States) . . . . . [TD06-23]
- 8:40 am: **21st century radius tolerancing**, Brandon Light, Richard Plympton, Optimax Systems, Inc. (United States) . . . . . [TD06-24]
- 9:00 am: **Designing cost-effective systems that incorporate high-precision aspheric optics**, Gregory W. Forbes, QED Technologies, Inc. (United States); Chris Brophy, Optical Engineering Services (United States) . . . . . [TD06-25]
- 9:20 am: **Develop alignment insensitive 4-mirror coaxial telescope designs using nodal aberration theory (Invited Paper)**, Kevin P. Thompson, Optical Research Associates (United States); William P. Kuhn, Opt-E (United States); Tobias Schmid, Jannick P. Rolland, CREOL, The College of Optics and Photonics (United States) . . . . . [TD06-26]
- 9:50 am: **Method of optical alignment using a laser tracking system**, Robert E. Parks, Optical Perspectives Group, LLC (United States) . . . . . [TD06-27]
- Coffee Break . . . . . 10:10 to 10:30 am
- 10:30 am: **Aligning optical elements to interferometric level accuracies**, Taeyoung Choi, Bob Harned, Noreen Harned, ASML Wilton (United States) . . . . . [TD06-28]
- 10:50 am: **Calculation of the vertex radius of an off axis parabolic surface using the sag measured with a three ball spherometer**, Hyun Kyoung An, The Univ. of Arizona (United States) . . . . . [TD06-29]
- 11:10 am: **Third-order compensation of misalignment-induced wavefront aberrations**, Lin Li, Jabil Circuit, Inc. (United States) . . . . . [TD06-30]
- 11:30 am: **An optical focus verification system for launch tracking telescopes**, David A. Imrie, Stephen D. Fantone, Daniel Orband, Jian Zhang, Optikos Corp. (United States) . . . . . [TD06-31]

## Wednesday 13 May

### SESSION 6

Room: Highland A. . . . . Wed. 8:00 to 10:00 am

#### Metrology

*Session Chair: Matthias Pfaff, OptoTech Optikmaschinen GmbH (Germany)*

- 8:00 am: **Characterization of a point diffraction interferometer with a quasicircular aperture**, Fermin-Solomon Granados-Agustin, Alejandro Cornejo Rodriguez, Esteban Rueda Soriano, Instituto Nacional de Astrofisica, Óptica y Electrónica (Mexico) . . . . . [TD06-32]
- 8:20 am: **Finish assessment of ultra precision optical surfaces using light scattering techniques**, Sven Schröder, Tobias Herfurth, Angela Duparré, Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany) . . [TD06-33]
- 8:40 am: **Adding quantum dots to abrasive slurries to detect subsurface damage in polished glass**, Wesley B. Williams, Brigid A. Mullany, Patrick J. Moyer, Wesley C. Parker, The Univ. of North Carolina at Charlotte (United States); Mark H. Randles, Northrop Grumman SYNOPTICS (United States) . . . . . [TD06-34]
- 9:00 am: **Practical considerations for assessing the spatial frequency measurement capability of an instrument**, Paul E. Murphy, QED Technologies, Inc. (United States); Richard N. Youngworth, Light Capture, Inc. (United States) . . . . . [TD06-36]
- 9:20 am: **Transmittance measurements of a large surface laser system**, Shen Zhu, Tim Adcock, U.S. Army Aviation and Missile Command (United States) . . . . . [TD06-37]
- 9:40 am: **Full area calibration of large optical flats**, Christopher J. Evans, C. Smith, James A. Soobitsky, M. Woynar, Zygo Corp. (United States) . . [TD06-66]
- Coffee Break . . . . . 10:00 to 10:20 am

### SESSION 7

Room: Highland A. . . . . Wed. 10:20 am to 12:00 pm

#### Advanced Technologies

*Session Chair: Arnie J. Bazensky, SCHOTT North America, Inc.*

- 10:20 am: **What's new in MTF testing? (Invited Paper)**, Daniel Orband, Stephen D. Fantone, Jian Zhang, Optikos Corp. (United States) . . . . . [TD06-38]
- 10:40 am: **Reactive pulse magnetron sputtered multifunctional optical coatings for high performance and for consumer optics**, Kerstin Taeschner, Hagen Bartzsch, Peter Frach, Eberhardt Schultheiss, Fraunhofer-Institut für Elektronenstrahl- und Plasmatechnik (Germany) . . . . . [TD06-39]
- 11:00 am: **Applying the dynamical model of drying process of a polymer solution coated on a flat substrate to effects of pinning the substrate**, Hiroyuki Kagami, Nagoya College (Japan) . . . . . [TD06-52]
- 11:20 am: **MEMS-based piezoelectric vibrational energy harvester (Invited Paper)**, Rob Andosca, Infotonics Technology Ctr. (United States) . [TD06-41]
- 11:40 am: **Ion beam figuring (IBF) plants for the correction of surface errors of high performance optics and mirrors between 5 and 700mm in diameter**, Thomas Franz, NTG Neue Technologien GmbH & Co. KG (Germany) . . . . [TD06-19]
- Lunch Break . . . . . 12:00 to 1:00 pm



## SESSION C1

Room: Empire Hall (Exhibition Hall) . . . . . Wed. 1:00 to 5:30 pm

### Commercial Presentations

Session Chair: **Walter C. Czajkowski**, Edmund Optics Inc.

- 1:00 pm: **Large quartz crystals for radiation-hard optical applications**, Vladimir Klipov, Sawyer Technical Materials, LLC (United States) . . . . . [TD06-100]
- 1:15 pm: **Wavefront measurement of miniature aspheric lenses: a fast and accurate inspection technology**, Iris Erichsen, Trioptics GmbH (Germany); Marie Cherrier, Trioptics France (France); Aiko Ruprecht, Trioptics GmbH (Germany) . . . . [TD06-101]
- 1:30 pm: **Advanced optical filters for laser applications**, Turan Erdogan, Semrock Inc. (United States) . . . . . [TD06-40]
- 1:45 pm: **Low-coherence surface metrology using a multiple-beam optical probe**, Damon W. Diehl, Christopher J. Ditchman, Christopher T. Cotton, ASE Optics, Inc. (United States) . . . . . [TD06-103]
- 2:00 pm: **Recent advances in lightweight glass mirrors**, James T. Mooney, ITT Corp. . . . . [TD06-116]
- 2:15 pm: **Human resources: what you don't know can cost you**, Jack Roche, Universal Photonics Inc. (United States) . . . . . [TD06-105]
- 2:30 pm: **Advances in the production of high precision aspheres**, Michael Sander, Satisloh GmbH (Germany); Lori B. Heller, Satisloh North America Inc. (United States) . . . . . [TD06-106]
- 2:45 pm: **Manufacturing of freeform optics at Jenoptik**, Uwe P. Birnbaum, Tobias Moeller, JENOPTIK Laser, Optik, Systeme GmbH (Germany) . . . [TD06-107]
- 3:00 pm: **Infrared materials from SCHOTT**, Ed Hart, SCHOTT North America, Inc. (United States) . . . . . [TD06-108]
- Coffee Break . . . . . 3:15 to 3:30 pm
- 3:30 pm: **Optical glass program of Schott news and outlook**, Peter Hartmann, SCHOTT AG (Germany) . . . . . [TD06-109]
- 3:45 pm: **Dynamic Fizeau interferometers**, Brian Medower, Bradley T. Kimbrough, 4D Technology Corp. (United States) . . . . . [TD06-110]
- 4:00 pm: **Fairfield crystal technology: manufacturer of high quality optical crystals and components from deep UV to far IR**, Andrew G. Timmerman, Fairfield Crystal Technology, LLC (United States) . . . . . [TD06-111]
- 4:15 pm: **Extended range transmission spheres**, Cody B. Kreisler, Kreisler Optics, Ltd. (United States) . . . . . [TD06-112]
- 4:30 pm: **Diversified ultra precision for 2009**, Jeffrey Perra, Moore Nanotechnology Systems, LLC (United States) . . . . . [TD06-113]
- 4:45 pm: **New processing technologies for spheres and aspheres**, Matthias Pfaff, OptoTech Optikmaschinen GmbH (Germany) . . . . . [TD06-114]
- 5:00 pm: **Software assisted scratch inspection**, David M. Aikens, Savvy Optics Corp. (United States); Ari Siletz, CCDMETRIX (United States) . . . . . [TD06-102]
- 5:15 pm: **Innovative surface measurement solutions for asphere, deep parabolic, ogive, and conformed geometries**, Scott DeFisher, Scott Bambrick, Michael J. Bechtold, David E. Mohring, OptiPro Systems (United States) [TD06-115]

## POSTERS—WEDNESDAY

Room: Empire Hall (Exhibition Hall) . . . . . Wed. 4:30 to 5:30 pm

Poster authors may set up their posters on Wednesday from 10:00 am to 4:30 pm. Posters will be available for viewing throughout the day.

Authors should be present for discussion during the Networking Reception from 4:30 to 5:30 pm.

Posters not removed by 6:00 pm will be considered unwanted and will be discarded.

- Possibility to measure the reflectance of spherical samples**, Hervé Piombini, Commissariat à l'Energie Atomique (France) . . . . . [TD06-35]
- Characteristics of angle tuning and conversion efficiency of ZnGeP<sub>2</sub>-DFG in mid-infrared laser**, Li Wang, Beijing Univ. of Technology (China) . . . . . [TD06-53]
- Substrate temperature influence on the properties of ZnO thin films by pulsed laser deposition**, Li Wang, Beijing Univ. of Technology (China) . . . . . [TD06-54]
- A new method of angle measurement with high-precision in computer vision based on spot array**, Weimin Li, Xiaofeng Li, Univ. of Science and Technology of China (China) . . . . . [TD06-56]
- The vision measurement technology of multiobject at a long range**, Xiaofeng Li, Weimin Li, Univ. of Science and Technology of China (China) . . . . . [TD06-57]
- Real-time imaging Stokes spectropolarimetry on the basis of polarization-holographic diffraction element**, Barbara N. Kilosanidze, George A. Kakauridze, Institute of Cybernetics (Georgia) . . . . . [TD06-58]
- The method of the precision measurement of an angle of rotation of polarization plane by means of polarization-holographic gratings**, Barbara N. Kilosanidze, George A. Kakauridze, Yuri Mshvenieradze, Institute of Cybernetics (Georgia) . . . . . [TD06-59]
- Polarization-holographic protection system**, Barbara N. Kilosanidze, George A. Kakauridze, Institute of Cybernetics (Georgia) . . . . . [TD06-60]
- Comparison of methods to determine power spectral density functions and rms roughness**, Sven Schröder, Marcus Trost, Tobias Herfurth, Angela Duparré, Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany) . . [TD06-61]
- Absolute planarity test with multiple measurements and iterative data reduction algorithm**, Maurizio M. Vannoni, Giuseppe Molesini, Consiglio Nazionale delle Ricerche (Italy) . . . . . [TD06-62]
- Pulsed solid-state laser induced annealing of amorphous-Si thin-films on different substrates**, M. Singaperumal, Niles J. Vasa, I. A. Palani, Indian Institute of Technology Madras (India) . . . . . [TD06-63]



# Technical Program

Thursday 14 May

## SESSION 8

Room: Highland A ..... Thurs. 8:00 to 10:00 am

### Aspheric Metrology

Session Chair: **Michael Mandina**, Optimax Systems, Inc.

8:00 am: **New metrology approach for the production of aspheric lenses**, Andreas Beutler, Carl Mahr Holding GmbH (Germany) ..... [TD06-42]

8:20 am: **Freeform optics measurements with the NANOMEFOS non-contact measurement machine**, Rens Henselmans, TNO Science and Industry (Netherlands); Lennino Cacace, AC Optomechanix (Netherlands); Geerten Kramer, TNO Science and Industry (Netherlands); Nick Rosielle, Maarten Steinbuch, Technische Univ. Eindhoven (Netherlands) ..... [TD06-43]

8:40 am: **Subaperture stitching interferometry of high-departure aspheres by incorporating configurable null optics**, Andrew W. Kulawiec, Markus Bauer, Gary M. DeVries, Jon F. Fleig, Gregory W. Forbes, Marcelo F. Guimaraes, Dragisha Miladinovic, Paul E. Murphy, QED Technologies, Inc. (United States) . . . . [TD06-44]

9:00 am: **Cross-testing of aspheric metrology techniques with subaperture stitching interferometry based on configurable null optics**, Gary M. DeVries, Jon F. Fleig, Paul E. Murphy, QED Technologies, Inc. (United States) . . . . [TD06-45]

9:20 am: **Measurement of aspheric lenses on a variety of instruments**, Raymond Castonguay, Piotr Szwaykowski, Engineering Synthesis Design, Inc. (United States) . . . . [TD06-46]

9:40 am: **IR LUPi with unusual positioning capability**, Peter Domenicali, Stephen D. Fantone, Optikos Corp. (United States) . . . . [TD06-47]

Coffee Break . . . . . 10:00 to 10:20 am

## SESSION 9

Room: Highland A ..... Thurs. 10:20 am to 12:00 pm

### Meter Class Optics

Session Chair: **Robert F. Novak**, APOMA and BAN Optical

10:20 am: **Meter-class vacuum-compatible optical collimators available for use at Ball Aerospace & Technologies Corp.**, Donald A. Byrd, Mark A. Martella, Jeff S. Parker, Ball Aerospace & Technologies Corp. (United States) . . . . [TD06-48]

10:40 am: **Precision figure correction of two-meter optics with Magneto-Rheological Finishing (MRT®)**, François Piché, Andrew R. Clarkson, L-3 Brashear (United States); William J. Messner, Christopher M. Supranowitz, Paul Dumas, QED Technologies, Inc. (United States) . . . . [TD06-49]

11:00 am: **Cost effective fabrication of meter class optics**, Pradeep K. Subrahmanyam, David Proscia, Steve Shifman, Thomas E. Metz, RAPT Industries, Inc. (United States); Paul R. Shore, Carlo Fanara, Will O'Brien, Renaud Jordain, Cranfield Univ. (United Kingdom) . . . . [TD06-50]

11:20 am: **A novel method of reducing the warp of sheet glass**, Mireille Akilian, Mark L. Schattenburg, Massachusetts Institute of Technology (United States) . . . . [TD06-51]

11:40 am: **National skill standards and education/training for precision optics technicians**, Daniel M. Hull, John Souders, OP-TEC (United States) . . . . [TD06-64]

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## Understanding ISO-10110: The Optics Drawing Standard

SC863

**Course Level: Introductory**  
**Wednesday 8:30 am to 5:30 pm**  
**CEU: 0.65 \$675 / \$770 USD**

This course provides attendees with an understanding of ISO-10110, the International Standard for Optics drawing notations. The course concentrates on the fundamentals of the drawing layout and notations required for typical optics, such as glass parameters, radius, wave-front, surface imperfections and roughness. Attendees are also introduced to all other sections of the drawing standard, including proper notation for aspheres, laser damage threshold, and transmitted wave front error. Practical and useful examples are included throughout. The course price includes copies of the basic drawing standards, ISO 10110-1 and ISO 10110-10.

### INSTRUCTOR

**David Aikens** is President and founder of Savvy Optics Corp.

COURSE PRICE INCLUDES copies of both ISO 10110-1:2006 Optics and photonics - Preparation of drawings for optical elements and systems - Part 1: General, and ISO 10110-10:2004 Optics and photonics - Preparation of drawings for optical elements and systems - Part 10: Table representing data of optical elements and cemented assemblies. Additional parts need to be purchased separately.

## Fundamentals of Single Point Diamond Turning

SC848

**Course level: Introductory**  
**Tuesday 1:30 to 5:30 pm**  
**CEU .35 \$305 / \$355 USD**

This course provides attendees with a basic working knowledge of single point diamond turning of optical components. The course covers a wide range of topics and should provide the attendee with an understanding of the process capabilities of this technology. Key subject matter includes; equipment, processes, cutting mechanics, material selection, fixturing, metrology, applications, component design, optical tolerancing, and producibility.

### INSTRUCTOR

**John Schaefer** is a Sr. Principal Process Engineer for ELCAN Optical Technologies, a Raytheon Company.

## Cost-Conscious Tolerancing of Optical Systems

SC720

**Course level: Introductory**  
**Wednesday 8:30 am to 12:30 pm**  
**CEU .35 \$305 / \$355 USD**

The purpose of this course is to present concepts, tools, and methods that will help attendees determine optimal tolerances for optical systems. Topics in the course apply to all volumes of systems being developed from single systems to millions of units. The course provides a background to effective tolerancing with discussions on variability and relevant applied statistics. Tolerance analysis and assignment with strong methodology and examples are then covered, with comments on treatment of active versus passive systems. The course concludes by giving a short introduction to useful tools like design of experiments and statistical process control. References and examples are included to help researchers, designers, engineers, and technicians practically apply the concepts to plan, design, engineer, and build high-quality cost-competitive optical systems.

### INSTRUCTOR

**Richard Youngworth** is the Director of Optical Engineering at Light Capture, Inc.

## Understanding Scratch and Dig Specifications

SC700

**Course level: Introductory**  
**Tuesday 8:30 am to 12:30 pm**  
**CEU .35 \$355 / \$405 USD**

Surface imperfection specifications (i.e. Scratch-Dig) are among the most misunderstood, misinterpreted, and ambiguous of all optics component specifications. This course provides attendees with an understanding of the source of ambiguity in surface imperfection specifications, and provides the context needed to properly specify surface imperfections using a variety of specification standards, and to evaluate a given optic to a particular level of surface imperfection specification. The course will focus on the differences and application of the Mil-PRF-13830, ISO 10110-7, and BSR/OP1.002. Many practical and useful specification examples are included throughout, as well as a hands-on demonstration on visual comparison evaluation techniques.

### INSTRUCTOR

**David Aikens** is the president and CEO of Savvy Optics.

COURSE PRICE INCLUDES a copy of the latest ANSI approved surface imperfections specification standard.

## Aspheric Optics: Design, Fabrication, and Test

### SC552

**Course level: Introductory**  
**Wednesday 1:30 to 5:30 pm**  
**CEU .35 \$390 / \$440 USD**

This course will provide attendees with a broad and useful understanding of aspheric surfaces and components. Aspheric or non-spherical surfaces in a lens or mirror system can bring significant benefits to the optical performance. This is not without the liabilities of added cost, delivery time, and even producibility. The course will begin with lens design, and specifically how and when to incorporate aspherics into a variety of lens design forms. We discuss what aspherics will do for a design, and also what they will not do. We then will discuss how aspheric surfaces are manufactured along with recommendations on how to specify aspherics. Several methods for predicting performance for systems with asphere induced wavefront irregularities will be shown. We also will discuss the testing of aspherics.

#### INSTRUCTOR

**Robert Fischer** is President and founder of OPTICS 1, Inc.

COURSE PRICE INCLUDES the text *Optical System Design, 2nd Edition* (SPIE Press, 2008) by Robert E. Fischer, Biljana Tadic-Galeb, and Paul R. Yoder, Jr.

## Optical Manufacturing Overview

### SC350

**Course level: Introductory**  
**Monday 8:30 am to 5:30 pm**  
**CEU .65 \$500 / \$595 USD**

This course provides a basic understanding of the methodology and processes used in the fabrication of precision optical elements. Emphasis is placed on the selection and use of tooling, materials and equipment used in the manufacturing process with specific examples.

#### INSTRUCTOR

**Robert Novak** is the president and CEO of BAN Optical.

## Optical Alignment Mechanisms

### SC220

**Course level: Intermediate**  
**Tuesday 1:30 to 5:30 pm**  
**CEU .35 \$305 / \$355 USD**

This is a practical "how to" course dealing with the design and fabrication of precision optical alignment and adjustment devices. The course uses example optical systems to identify typical alignment requirements and provides a catalog of proven adjustment techniques.

#### INSTRUCTOR

**Robert Guyer** specializes in the design of lasers, stable optical mounts, gimbaled systems, and precision mechanisms. Mr. Guyer is an Engineering Fellow at BAE Systems in Nashua, New Hampshire.

## Modern Optical Testing

### SC212

**Course level: Intermediate**  
**Monday 1:30 to 5:30 pm**  
**CEU .35 \$315 / \$385 USD**

This course describes the basic interferometry techniques used in the evaluation of optical components and optical systems. It discusses interferogram interpretation, computer analysis, and phase-shifting interferometry, as well as various commonly used wavefront-measuring interferometers. The instructor describes specialized techniques such as testing windows and prisms in transmission, 90-degree prisms and corner cubes, measuring index inhomogeneity, and radius of curvature. Testing cylindrical and aspheric surfaces, determining the absolute shape of flats and spheres, and the use of infrared interferometers for testing ground surfaces are also discussed. The course also covers state-of-the-art direct phase measurement interferometers.

#### INSTRUCTOR

**James Wyant** is Dean of the College of Optical Sciences and Professor of Optical Sciences at the University of Arizona. He was a founder of the WYKO Corporation and served as its president from 1984 to 1997.

COURSE PRICE INCLUDES the text, *Field Guide to Interferometric Optical Testing* (SPIE Press, 2006) by Eric P. Goodwin and James C. Wyant.

## Structural Adhesives for Optical Bonding

### SC015

**Course level: Intermediate**  
**Tuesday 8:30 am to 12:30 pm**  
**CEU .35 \$305 / \$355 USD**

Optomechanical systems require secure mounting of optical elements. This important aspect of the design can cause a production to stop if sound engineering is not applied. A wide variety of adhesives are discussed with respect to their relevant properties. Design considerations, differing mounting techniques, production concerns, and reliability are reviewed. The instructor gives success and failure case histories.

#### INSTRUCTOR

**John Daly** has been a consultant for the past 10 years. Daly has more than 20 years of experience in academia, aerospace, medical, commercial, and industrial fields.

## Precision Mounting of Optical Components

### SC013

**Course level: Introductory**  
**Monday 8:30 am to 5:30 pm**  
**CEU .65 \$585 / \$680 USD**

This introductory-level, one-day course reviews key influences of adverse environments on optical components and instruments, important characteristics of materials, and techniques commonly used to mount individual and multiple lenses, windows, shells, optical filters, prisms and small to moderate sized mirrors. Mounting means include retaining rings, flanges, spring clips, adhesives, sealing compounds, and flexures. Techniques for estimating stress buildup within typical optical components due to imposed mounting forces are summarized. Effects of temperature changes on optomechanical assemblies and athermalization techniques are also summarized. Examples of component mountings in typical optical instrument applications are considered throughout the course in order to illustrate successful design configurations.

#### INSTRUCTOR

**Paul Yoder, Jr.** has continued to serve various clients as an independent consultant in optical and optomechanical engineering following a 40-year career in optical engineering with U.S. Government and industrial organizations.

COURSE PRICE INCLUDES the newly revised and expanded text, *Mounting Optics in Optical Instruments, 2nd edition* (SPIE Press, 2008), by Paul R. Yoder, Jr.



